Coursework II

Analysis using the Geodatabase

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Abstract

The Isle of Wight has seen 52% of its 42 bank branches close from the year 2014 to 2019. This has been a result of a decline in the use of physical bank branches and a rise in the usage of internet banking. This is also in line with the studies across the world pertaining to different facilities, where internet services have replaced physical locations of the facilities. However, not everyone has the same access to the internet, and certain demographic groups and communities might struggle with accessibility due to factors like old age, illiteracy and so on. This study uses the Network Analyst Toolbox in ArcMap to make use of the bank catchment areas to identify the postcodes and population of Isle of Wight that are serviceable by the physical bank branches, and those who lie out of them. The unserviceable areas should be the areas that the concerned authorities must focus on to improve the banking services, especially for the customers that cannot afford to use alternatives and hence, are the most impacted.

Introduction

Most studies in the area of accessibility to a certain facility have been focussed on healthcare infrastructure. (Langford, Higgs and Jones, 2020) is probably the very first studies to focus on banking services, which shows that although geospatial techniques have been used for location planning for banks, the area of accessibility still remains unexplored. The paper explored the fact that how cash or banking 'deserts' have been introduced due to the reduction in banking provisions without consulting the communities, and how the customers who use deposits and cash withdrawals have been impacted the most. The study of the economic impact of bank branch closure has taken place over the UK – the House of Commons Report (Edmonds, 2018) and the reports from the devolved institutions in Scotland and Wales. (Langford, Higgs and Jones, 2020)

(Comber *et al.,* 2008) Demonstrated that GIS Network Analysis of accessibility and the statistical analysis of the demographic data can be utilised in evaluating the impacts of the locations and the reduction in the number of facilities – post offices in this case, on certain groups. (Hidayati, Tan and Yamu, 2021) investigates the impact of mobility inequality on employment opportunities, especially in the Covid pandemic, while (Tomasiello, Giannotti and Feitosa, 2020) provides a model that may be used to determine the impacts of transport interventions in promoting gentrification on other facilities, like banking, as well. (Shen and Chiou, 2011) provide an insight into the antecedents to adoption of online financial services – how different cultures and countries approach internet banking provisions and the apprehension to them due to security concerns.

In the *Methodology* section, the text discusses about the preparation of data using data from different sources and joining them for further analysis. This analysis is carried out using the Network Analyst

Toolbox in ArcMap for the various variables chosen for the study for the two years and the illustrations are included accordingly. The serviceable postcodes are recognised, the demographic communities affected by bank closures are identified and considerations are made for the internet broadband speeds available on the island. The results are discussed in the *Results* section, and although most of them are visual interpretations, a table delineates the decline in the people lying in the serviceable postcodes buffers. The *Discussion* section elaborates on the technique used and whether there exist alternatives for a similar analysis. Finally, the report concludes with the findings and suggestions to the banks and the local authorities so as to help alleviate the effects of bank branch closures especially affecting communities facing hardships due to inequalities.

Methodology

This section is divided into two – Preparing the Dataset and Network Analysis. The maps shown in the report were made in ArcMap 10.6.1 and the Landscape mode was used in the Layout view to get the resulting maps. Colorbrewer was used to set the colour scheme so as to make the maps readable for colour-blind people.

Preparing the Dataset

As for the Coursework 1, OS Code Point open dataset for Isle of Wight was acquired from the Digimap service (EDINA Digimap Ordnance Survey Service, 2022) and the x and y coordinates for the postcodes projected on to the layer for the boundary dataset for the island. (UK Data Service, 2017)The shapefile for the bank locations according to the House of Commons report (Edmonds, 2018) was joined with the above data, and a selection query was run to create two different layers – Banks open in 2014 and Banks open in 2019. The NOMIS dataset for the population counts for the Isle of Wight was then projected on to get the total population. (Office for National Statistics, 2013) Furthermore, to get the Car Ownership, Age and Qualification data was obtained from the UK Data Service and joined with the above to get OA_Joined_Dataset. (UK Data Service, 2013) For the line vector file for the roads on the island, again, the Digimap service was used and the was joined with the above. This is vital for the Network Analysis performed in the next part.

For the OFCOM Broadband speeds dataset by postcodes provided to us, the x and y coordinates from the .csv file was projected and saved as a points feature layer. Then two different 50m raster surfaces were created using the Inverse Distance Weighting method for the two speeds – 2mbps and 10mbps, for the island.

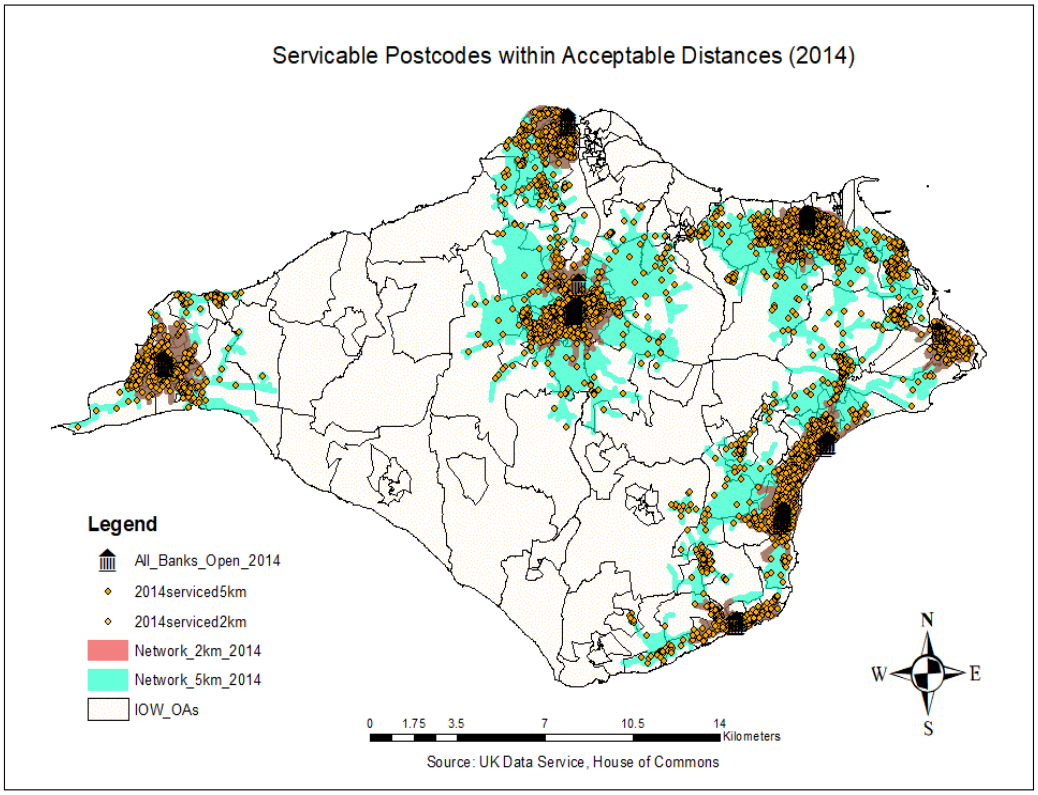
For the variables used in the Network Analysis, the field calculator was used in the OA_Joined_Dataset to get the percentage of people without private vehicles, percentage of elderly population, and the percentage of people above 65 years of age without a qualification. These will be used to determine the impacts of bank closures and the low internet speeds which hamper internet banking for the marginalised demographic groups along with the OAC supergroups – Constrained City Dwellers, Hard-Pressed Living, Rural Residents, Suburbanites and Urbanites.

The road networks have been used in the analysis but not been shown in the maps below since they were not needed visually and would have resulted in overcrowding of the map document.

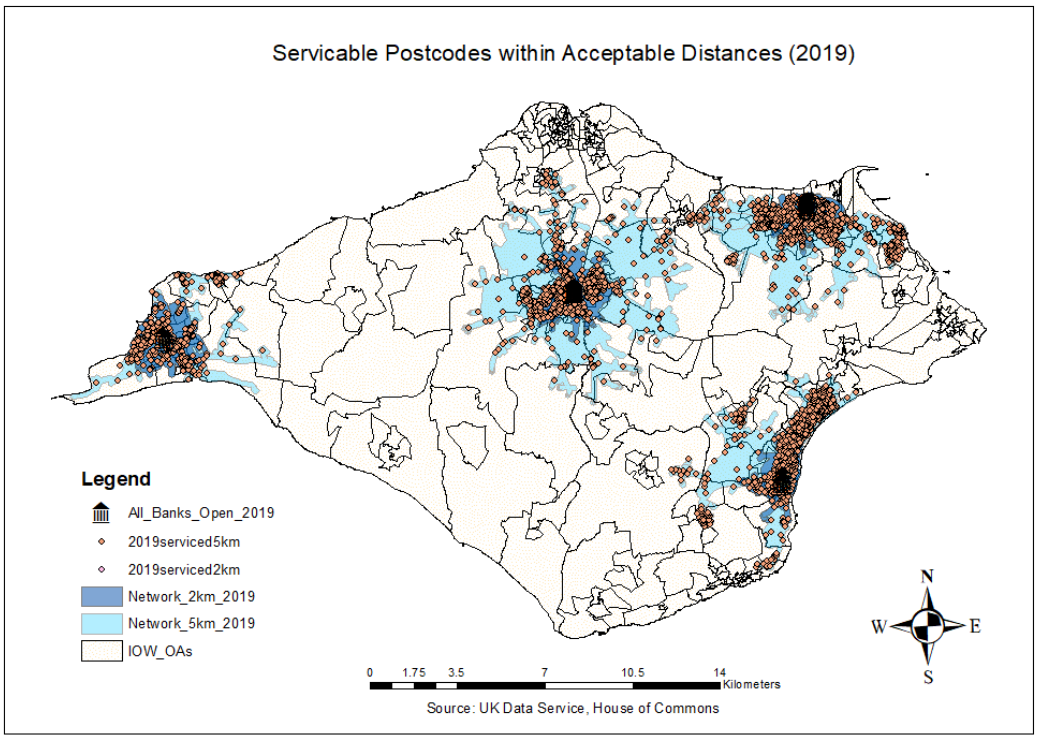
Network Analysis

1. **Serviceable Postcodes**: It is assumed that walking and cycling for within 2km and 5km respectively, makes a facility accessible but for exceptional cases. Walking is the most desirable mode of transport at the local level and both walking and cycling may be a considered a substitute for cars for shorter trips. (Department for Communities and Local Government, 2001) Therefore, for the two maps below, it is assumed that both 2km and 5km fall in the serviceable distances for the banks.

   On the Isle of Wight Output Area boundary layer, the banks and the postcodes were projected. Then, a network buffer of 2km and 5km impedance was created using the Network Analyst Toolbox in ArcMap for both years – 2014 and 2019. It is to be noted that there is an obvious overlap between the 2km and 5km serviced postcode points.



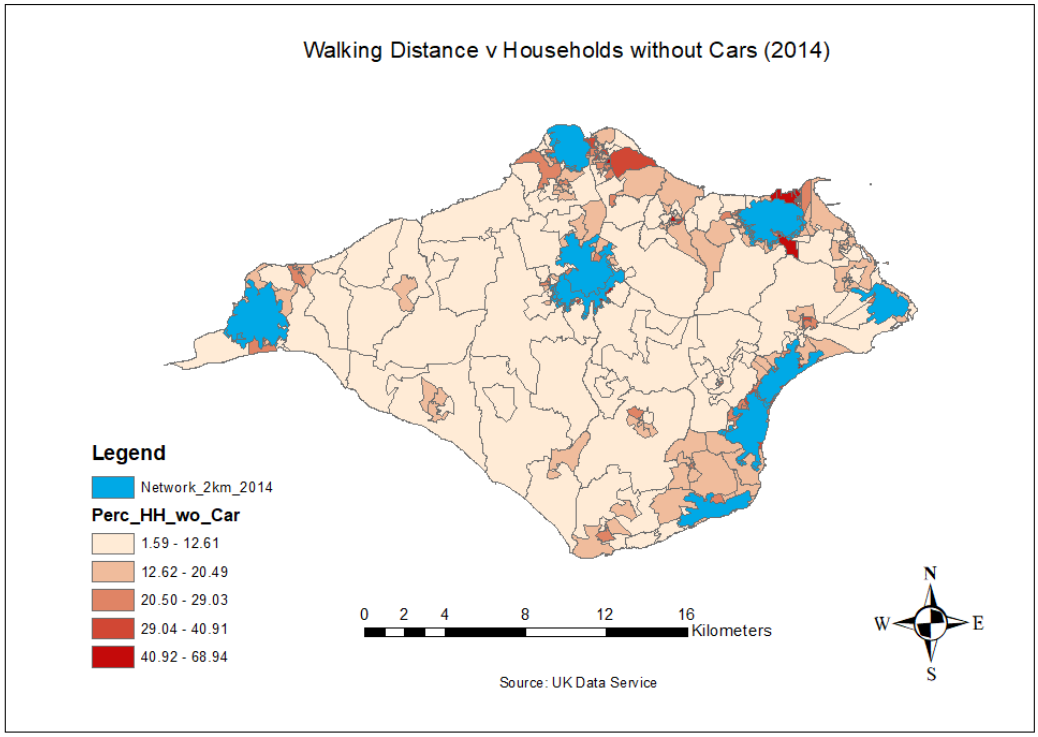
Map 1: Serviceable Postcodes 2014



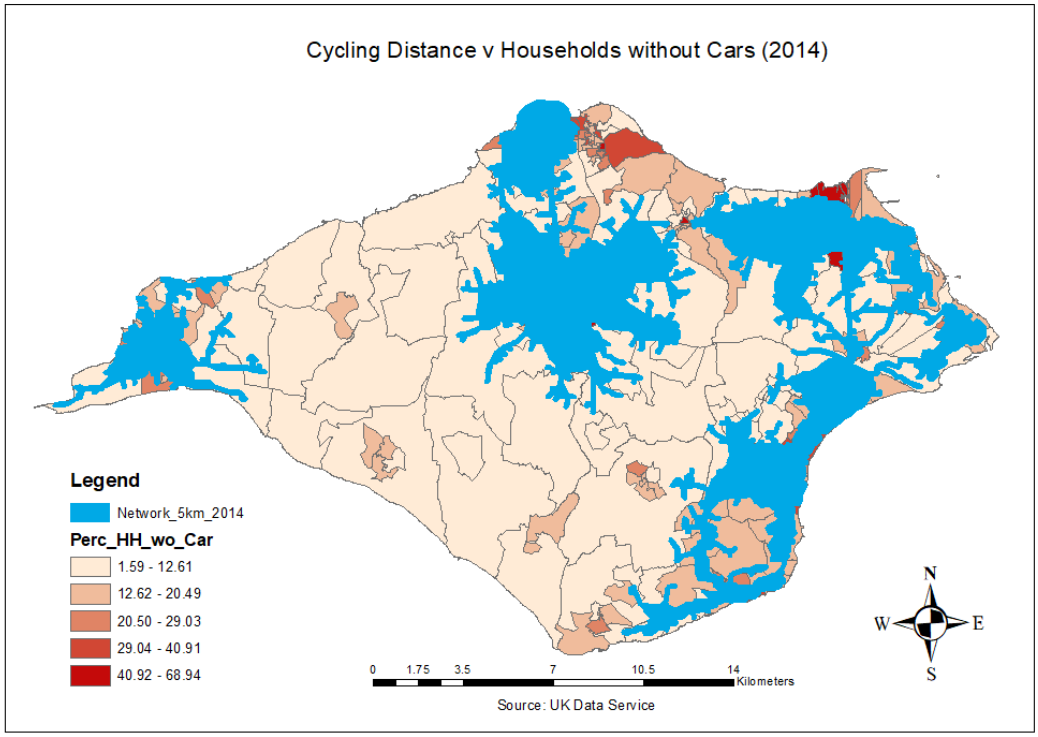
Map 2: Serviceable Postcodes 2019

2. **Identifying demographic groups and communities**: As mentioned in the data preparation section above, the variables chosen to study the impact of bank closure amongst the population are as follows – percentage of people without private vehicles, percentage of elderly population (65 and above), and the percentage of elderly population without an educational qualification. Moreover, from the OAC supergroups, the following were represented - Constrained City Dwellers, Hard-Pressed Living, Rural Residents, Suburbanites and Urbanites.

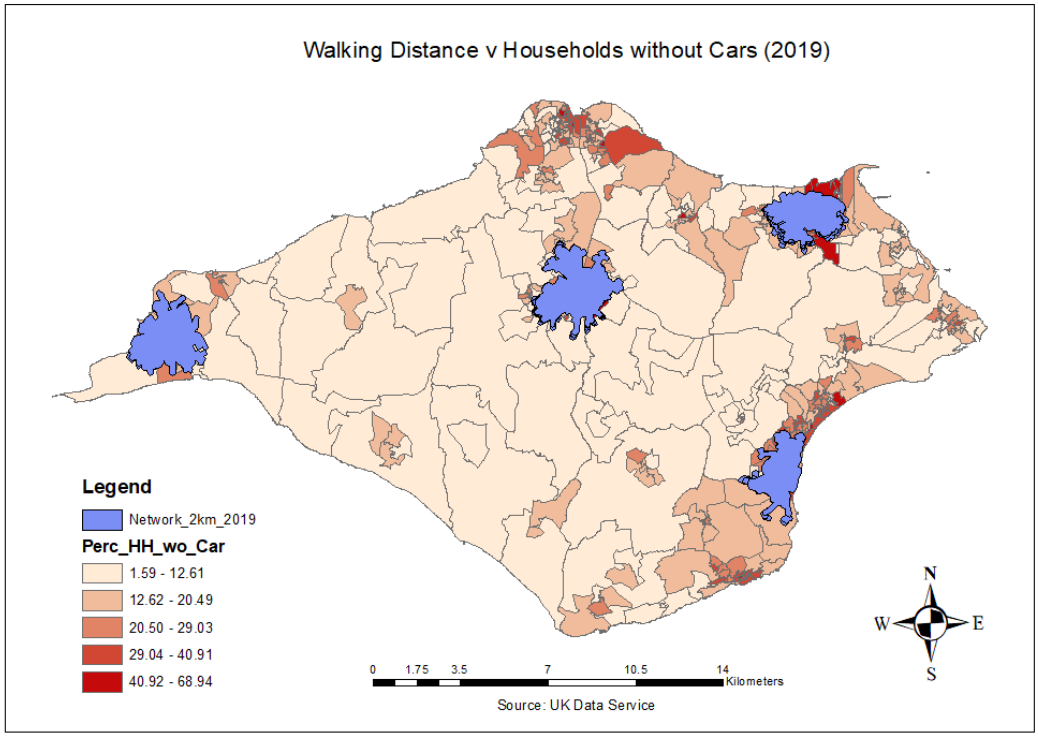
   For each of these variables, a network buffer for 2km and 5km impedance was made for both the years – 2014 and 2019. Since, there was no postcode data available for the variables (only OA polygons were present in the dataset), the layers could not be intersected without a key, and hence, only a visual analysis of the resulting maps could take place. The maps are shown below:



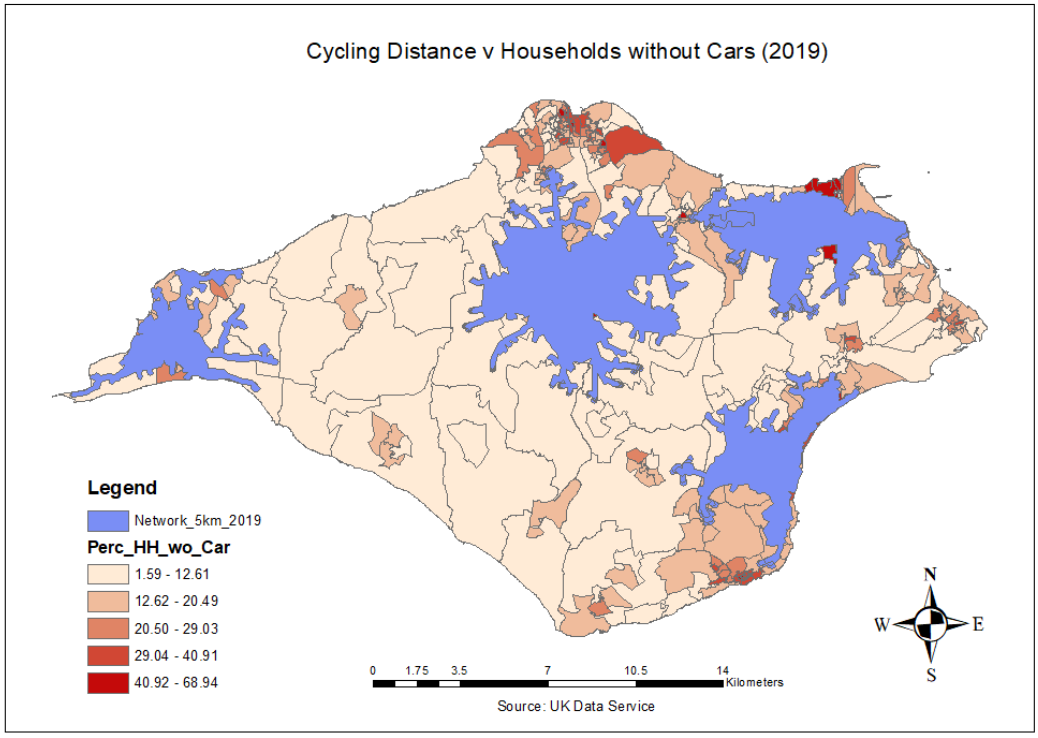
Map 3: Percentage of People without Cars and 2km Network Buffer 2014



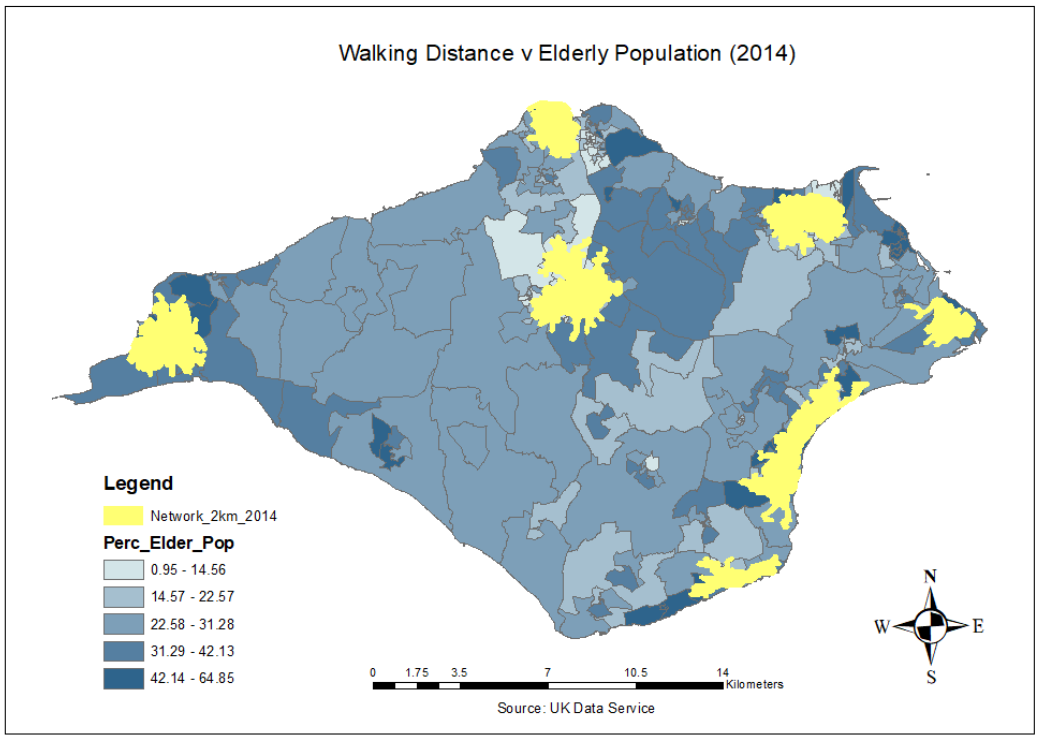
Map 4: Percentage of People without Cars and 5km Network Buffer 2014



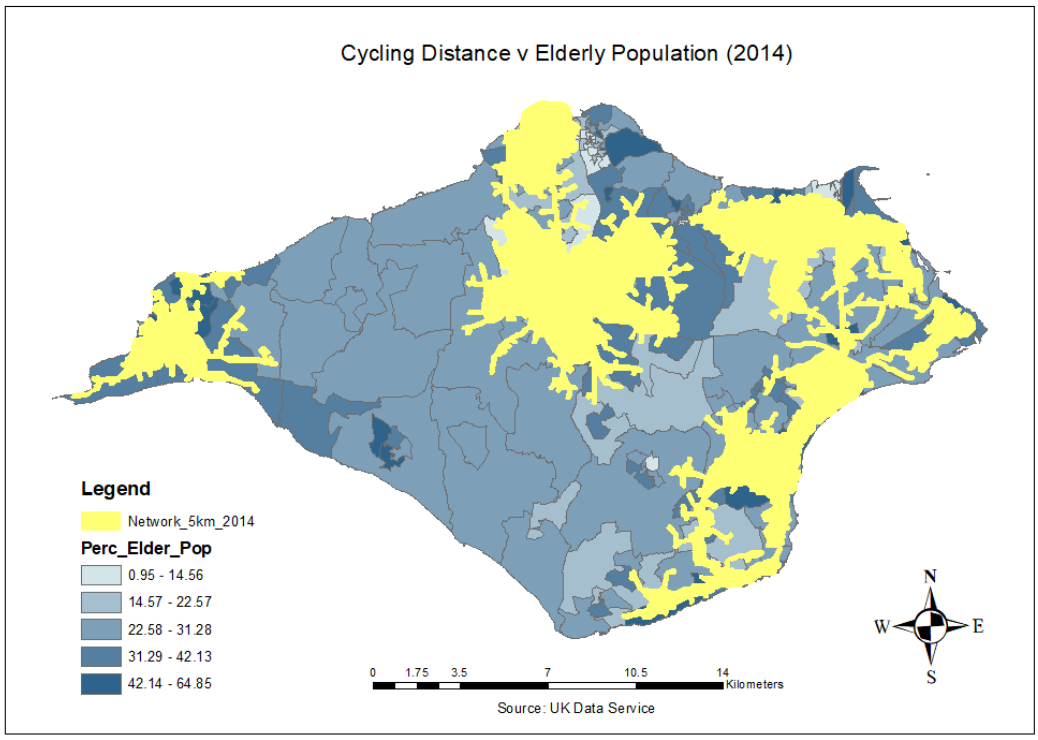
Map 5: Percentage of People without Cars and 2km Network Buffer 2019



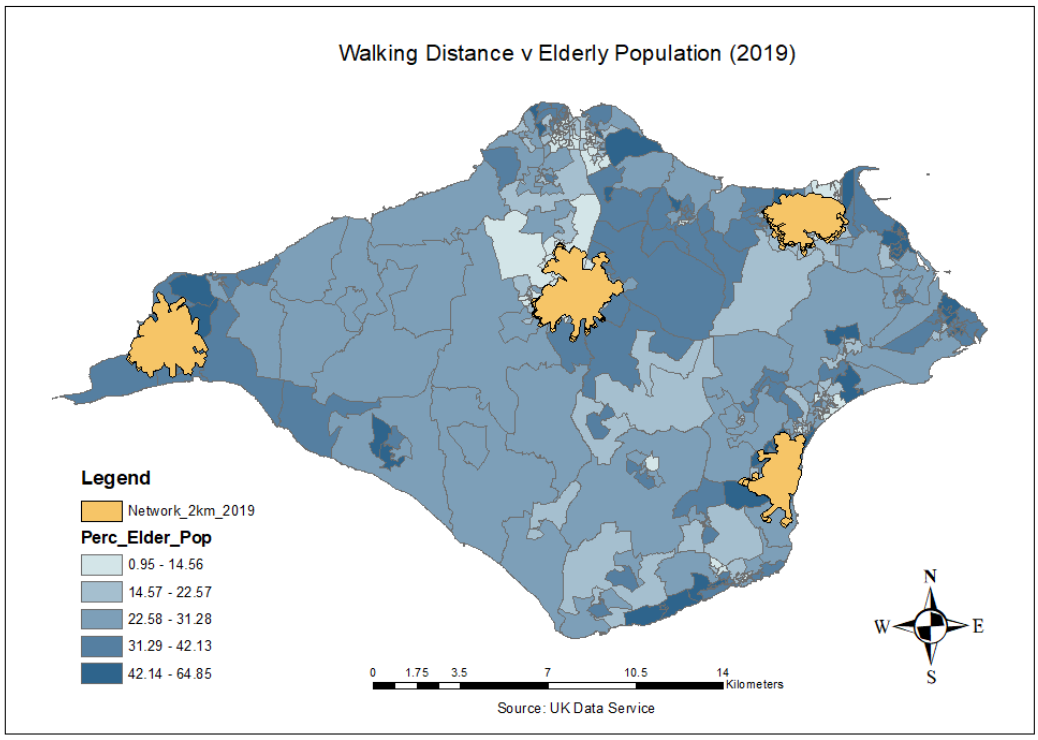
Map 6: Percentage of People without Cars and 5km Network Buffer 2019



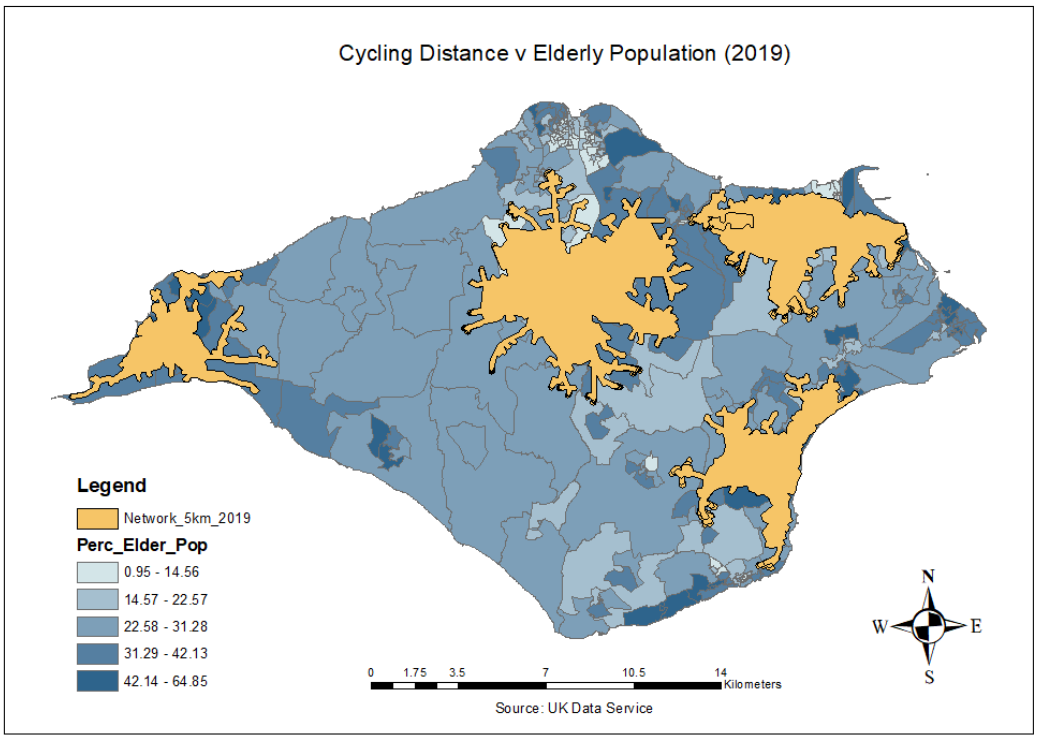
Map 7: Percentage of Elderly and 2km Network Buffer 2014



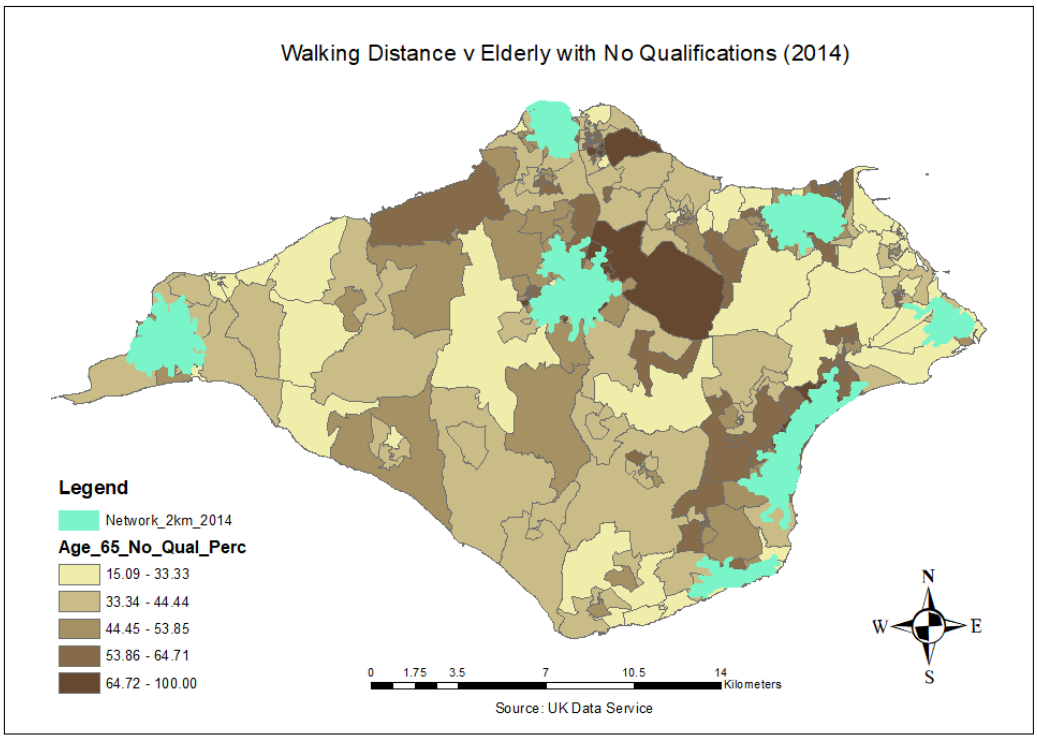
Map 8: Percentage of Elderly Population and 5km Network Buffer 2014



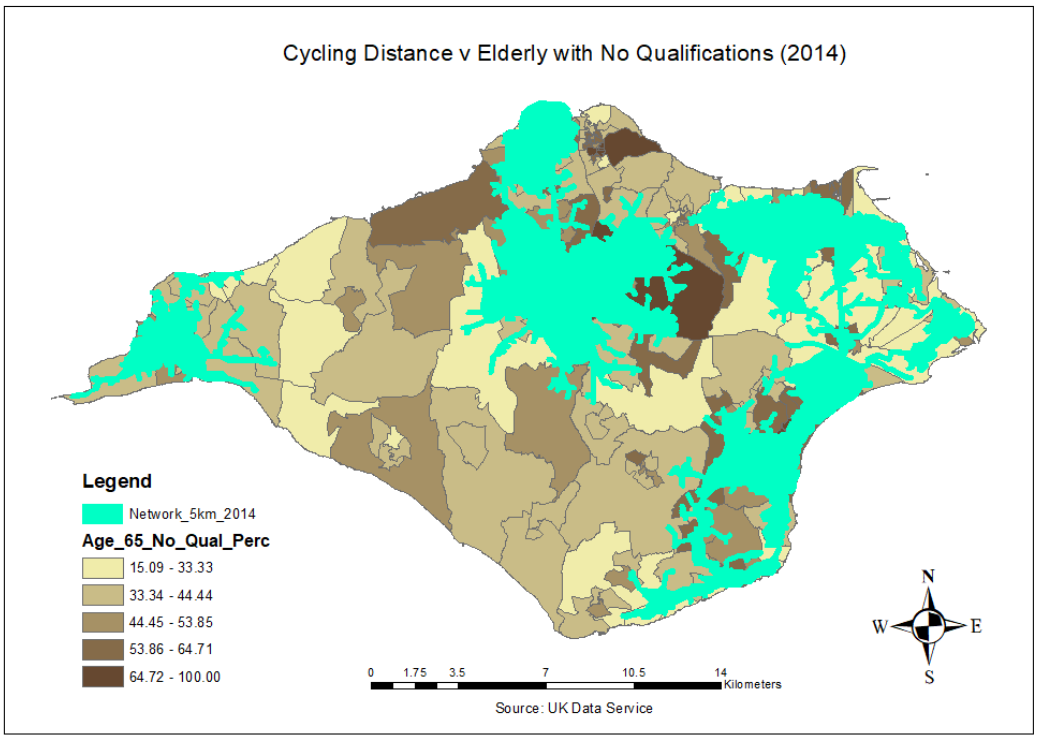
Map 9: Percentage of Elderly Population and 2km Network Buffer 2019



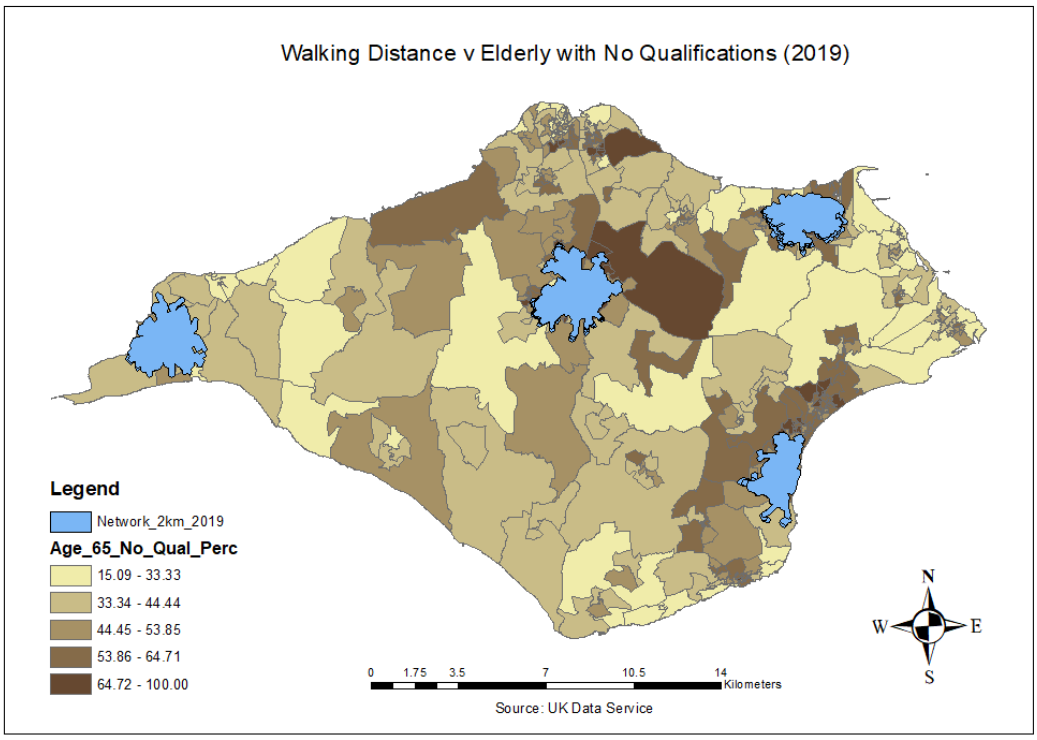
Map 10: Percentage of Elderly Population and 5km Network Buffer 2019



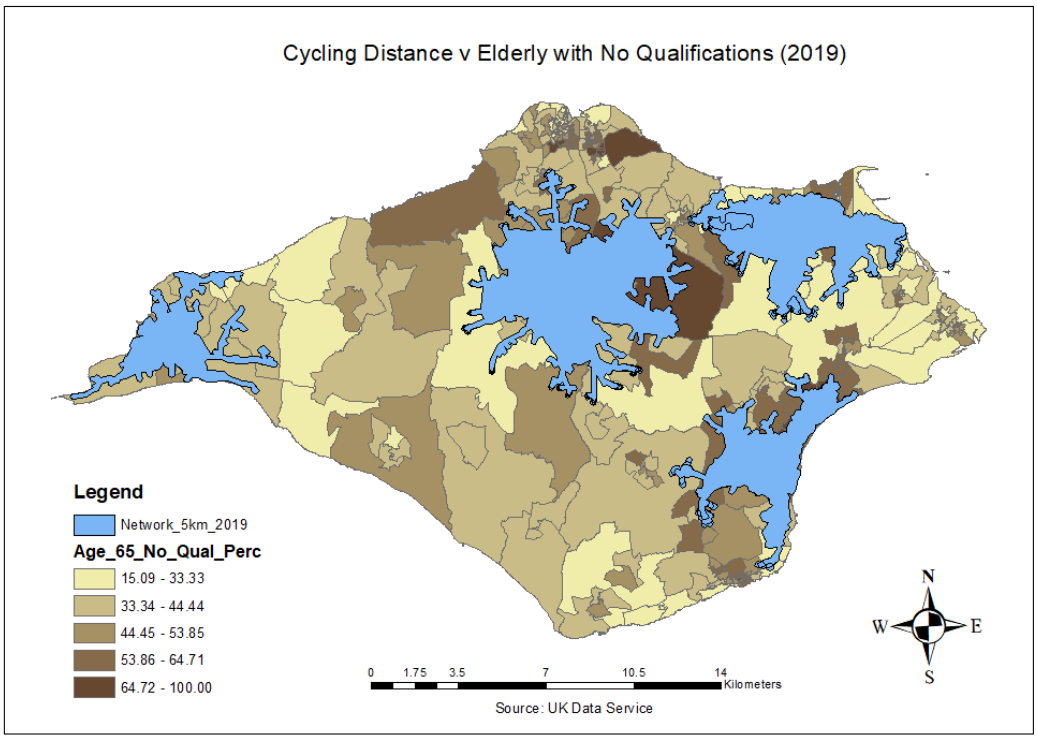
Map 11: Percentage of Elderly Population without Qualifications and 2km Network Buffer 2014



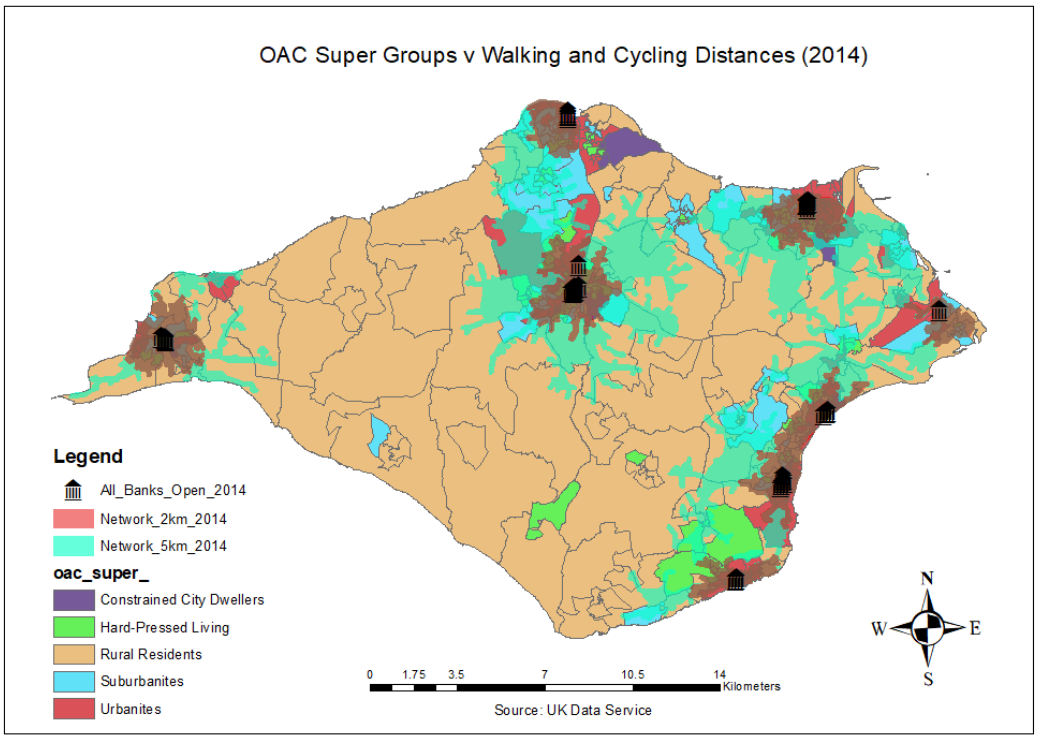
Map 12: Percentage of Elderly Population without Qualifications and 5km Network Buffer 2014



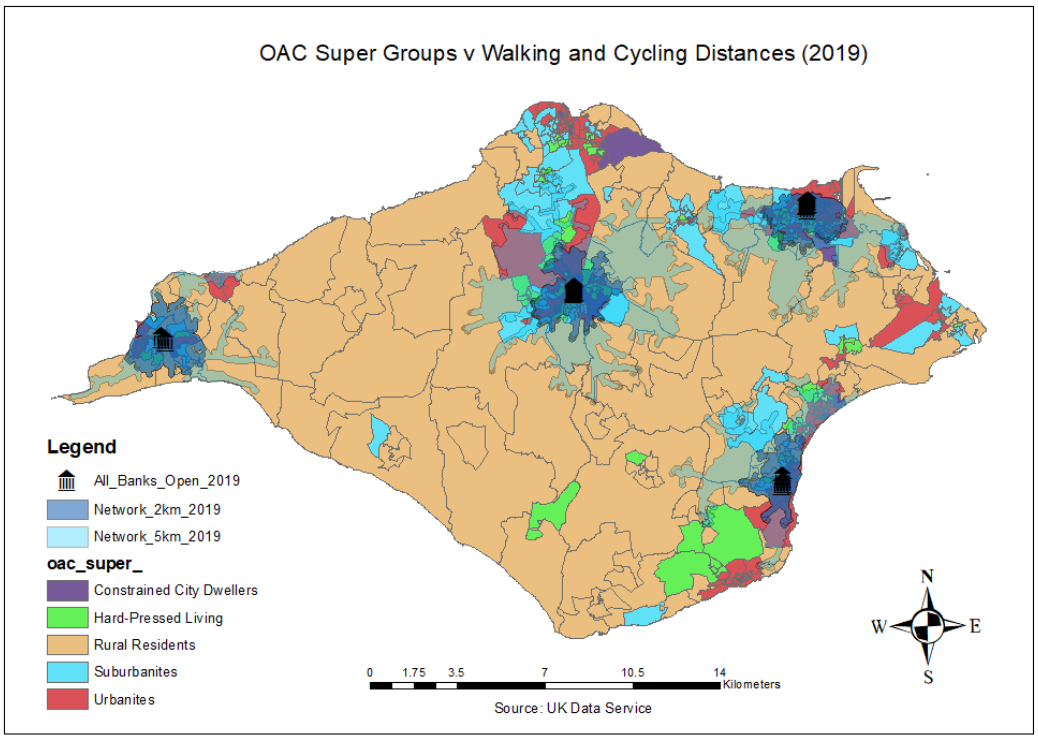
Map 13: Percentage of Elderly Population without Qualifications and 2km Network Buffer 2019



Map 14: Percentage of Elderly Population without Qualifications and 5km Network Buffer 2019



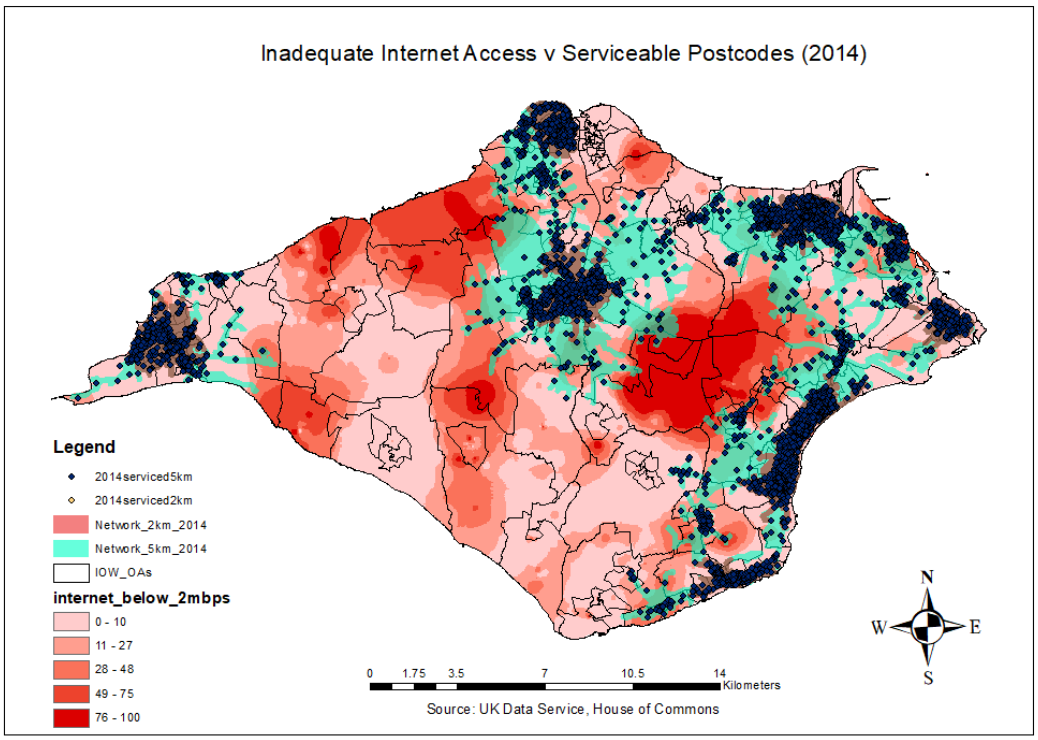
Map 15: OAC supergroups and 2km & 5km Network Buffer 2014



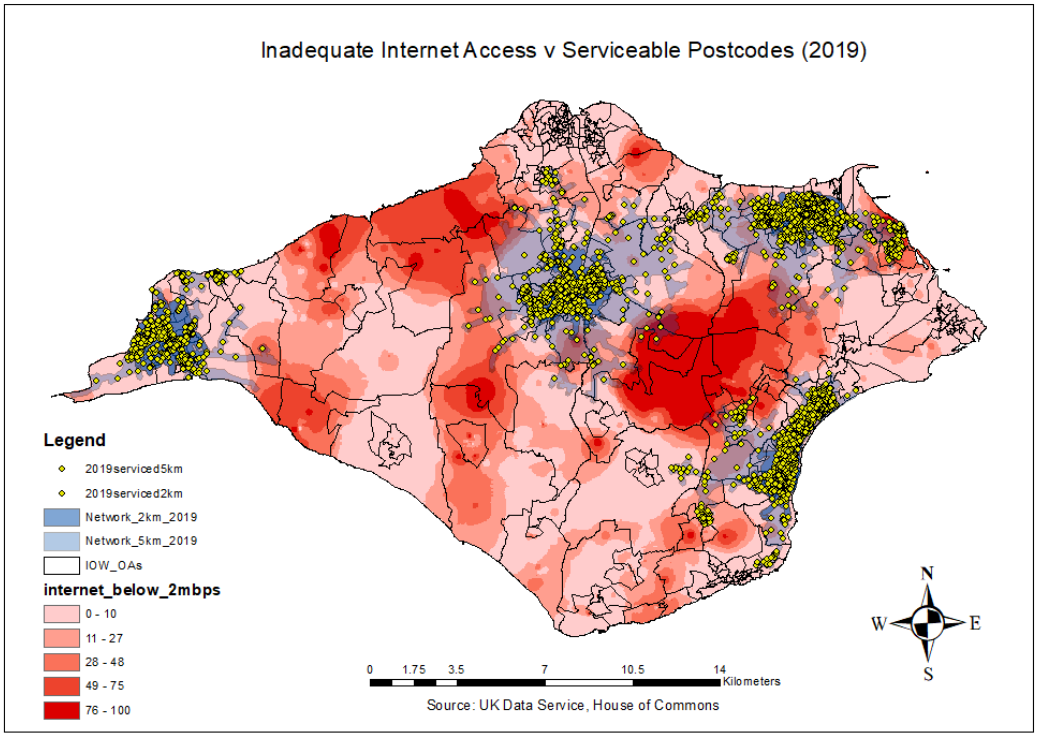
Map 16: OAC supergroups and 2km & 5km Network Buffer 2019

3. **Consideration for Internet Banking**: For the given dataset, it is assumed that broadband speed of 2mbps is considered inadequate, and hence it will hamper the resident population in accessing online banking services majorly. A broadband speed of 10mbps is considered insufficient, i.e., a person may be able to access online banking services but it may be a very slow process and some hinderance is assumed to be present in access at such low speeds.

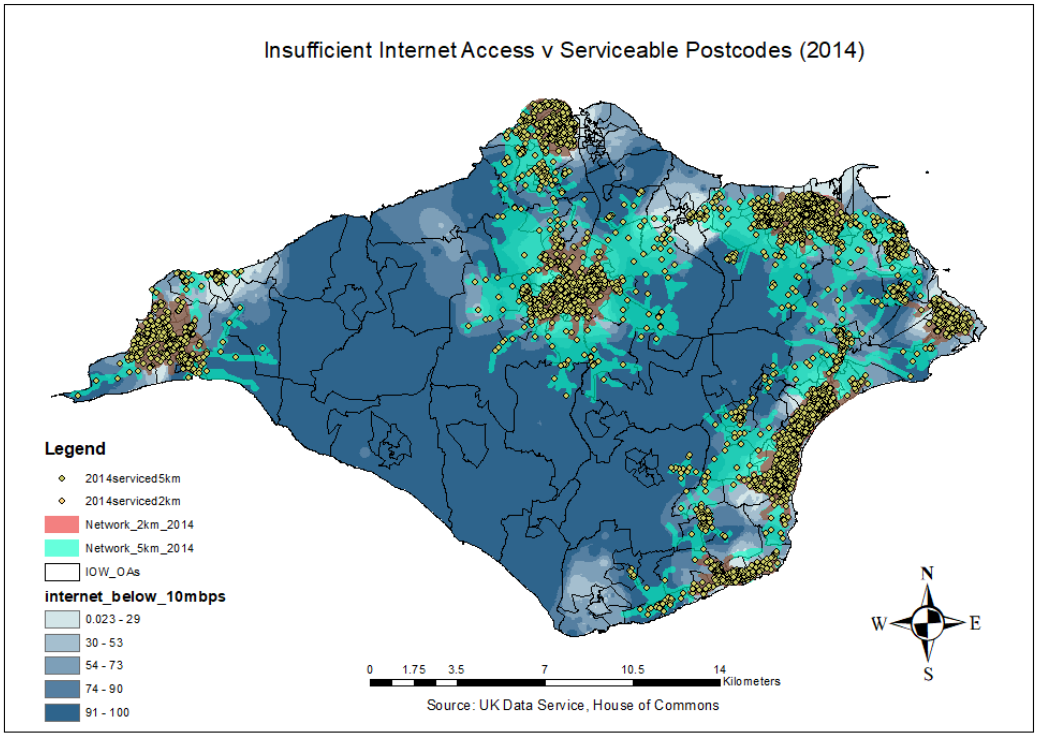
   For the raster layers from the preparation section, the symbology was changed so as to project the amount of people receiving the said broadband speed – 2mbps or 10mbps on the Isle of Wight. Then the postcode layer was projected on to it to determine visually, the postcodes getting either insufficient or entirely inadequate internet broadband speeds. Finally, network buffers for 2km and 5km around the bank branches were created to determine the populations and postcodes areas lying outside the accessibility zone and who have low internet broadband speeds which will restrict them from using online banking services, especially after the bank closures from 2014 to 2019. The maps do provide the percentages of people receiving the above mentioned internet broadband speeds, however, again since the lack of postcode data present for the OFCOM dataset, the exact statistics regarding the populations getting restricted internet access could not be determined. Once again, the postcode points lying in both the 2km and 5km network buffer will intersect. Only visual analysis is possible from the given maps:



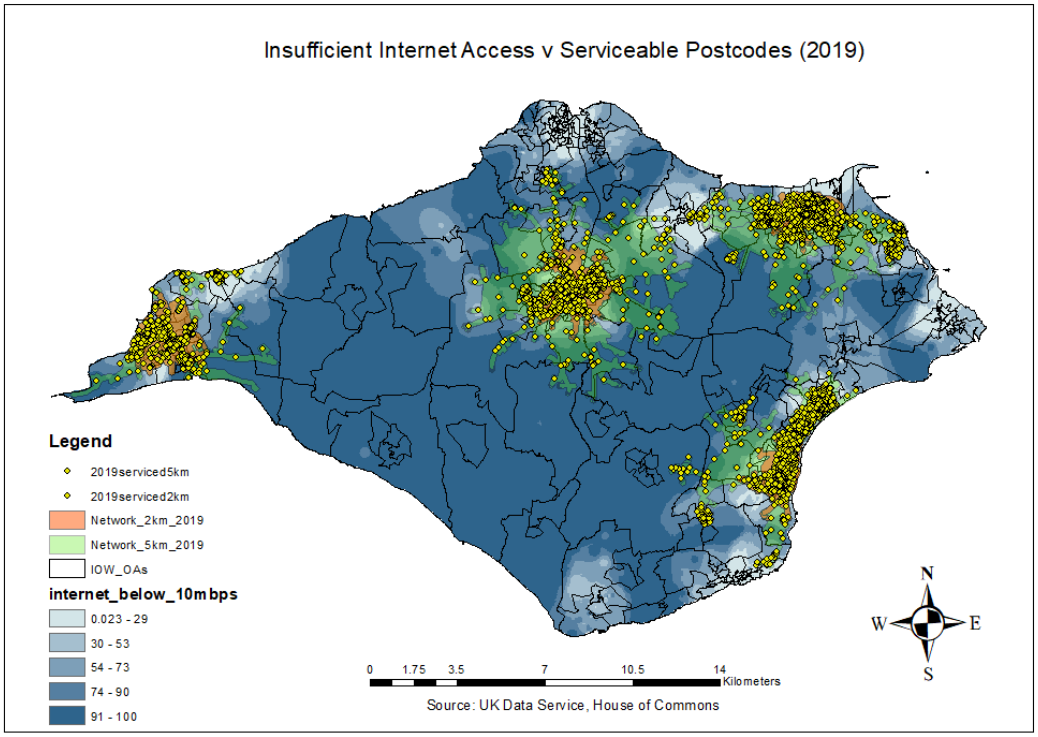
Map 17: Inadequate Internet access and Serviceable Postcodes 2014



Map 18: Inadequate Internet access and Serviceable Postcodes 2019



Map 19: Insufficient Internet access and Serviceable Postcodes 2014



Map 20: Insufficient Internet access and Serviceable Postcodes 2019

Based on the above maps, the following results were derived, either statistically or visually, whichever was possible with the given data.

Results

From Maps 1 & 2, the total postcodes, the number of households and the residents of the people living in the serviceable distances was found out using the statistics option for the respective fields in the attribute table.

Table 1: Postcodes, Households and Residents within Network Analysis Buffers

	Postcodes	Households	Residents
		2014	
Within 2 km Walking Distance	2758	40850	93072
Within 5 km Cycling Distance	3691	51289	116151
		2019	
Within 2 km Walking Distance	1789	27083	61648
Within 5 km Cycling Distance	2720	38538	88403
Total	4558	61081	138260

The table above shows that there has been a fall in the number of people lying inside the Network buffers and hence would find it difficult to access the banks. In 2019, the change is as follows- 26.30% postcodes, 24.86% households and 23.89% residents; in excess find it more difficult now to access banks either through walking or cycling.

Maps 3,4,5 and 6 show an interesting trend where the number of people living in the rural areas tend to have more cars than those who live in urban and suburban areas. This has hardly changed from 2014 to

2019, while the number of banks open have been reduced. This trend will result in more people from the city finding it difficult to access physical bank branches.

Maps 7,8,9 and 10 show that while the elderly population data has not quite changed, however, the accessibility to bank branches has reduced significantly, especially in the north and the south. This, assuming the fact that the elderly population will still use bicycles to move around. Walking to a bank branch however, is difficult for most of the elderly population both in 2014 and 2019, especially in the centre of the island where 32-43% of elderly live.

As with the other variables, Maps 11,12,13 & 14 show that the accessibility to bank branches is greatly reduced for the elderly population without a degree in the north and the south. While cycling may be an option for these people in the central region, the south-west of the island remains unserviceable for areas with 45-54% of them.

Maps 16 & 17 show that the number of urbanites, suburbanites and the people falling in the category of 'hard-pressed living', are now excluded from the network buffers in 2019, for which they were a part of in 2014. This compounded with the fact that most of them either do not or cannot afford a private vehicle makes the physical bank branches inaccessible to them. The rural areas still largely remain unserviceable by the bank branches.

From Maps 17 & 18, coincidentally, the results show that the areas outside of the network buffers have a high percentage of people receiving inadequate internet access, i.e., less than 2mbps of broadband speed. This, however, might not be a coincidence at all since most of the bank branches fall in the city or suburban areas and the rural areas are excluded mostly. Therefore, it can be concluded that the rural residents mostly do not have access to both physical and internet banking services.

While an internet broadband speed below 10mbps may allow customers to access internet banking services, most of it would be slow and some services might not even work for such low speeds. This is the scenario for almost the entire island, with better speeds only available at hotspots where the physical bank branches are already present.

Discussion

Whilst Network Analysis is a better approach over Buffer Analysis since it reduces redundancies in the facilities data by eliminating straight-line distances and sketches the road network along the chosen impedance distances, there are still a few variables that this approach does not consider. For instance, it is not certain that the residents of a postcode will use the nearest bank branch available to them. Individuals may choose to opt for a bank closest to their workplace, is the same bank that their family and relatives use or might have a preference of the brand of the bank. (Langford, Higgs and Jones, 2020)

Moreover, the study does not account for the time it takes to use a road, which is dependent on the road length, although Network Analysis gives the user an option to do so. (Balasubramani, Gomathi and

Prasad, 2016) Furthermore, the study does not take into other aspects like the topography and the road infrastructure of the location – since more cities are now being developed that are car-centric, lack sidewalks for pedestrians etc. For the marginalised groups, this can compound on their misery since local authorities usually do not take into consideration the accessibility to public transport for them. (Hidayati, Tan and Yamu, 2021) To account for these variables, studies like (Tomasiello, Giannotti and Feitosa, 2020) may be used to map inequalities and accessibilities for certain demographic groups; while more accurate accessibility measurements can be carried out through Floating Catchment Area technique. (Langford, Higgs and Jones, 2020)

The report clearly portrays that there has been an increase in the number of people who in 2019 fail to access banking services due to physical bank branch closures. Also, it confirms some pre-conceived notions about planning – how urban dwellers expect to travel shorter distances to access facilities (Langford, Higgs and Jones, 2020) compared to the rural residents, and therefore, would not require private vehicles to get around in the case of Isle of Wight; and the internet broadband services being inadequate for rural areas as compared to the better speeds in urban areas.

Conclusion

From the results and findings in the report above, it can be concluded that it might have been an ill-informed decision to close more than 50% of the physical bank branches, while there exists no decent internet infrastructure. More than a 20% increase was seen in the number of people losing access to physical branches from 2014 to 2019, most of whom would already find it difficult to navigate around financial institutions like the elderly, people without private vehicles and the people not fortunate enough to receive even a Level 1 qualification. While the number of rural residents owning cars is higher than the people in urban areas, the divide amongst them is great with people in rural areas not receiving even the basic amenities like sufficient internet broadband speeds. Although alternatives like mobile banking may be introduced, acceptability remains uncertain and requires further studies. To reduce the pressure on the existing branches, and to ensure ease of access to internet banking for customers, the authorities must work along with banks in order to find solutions like consulting customers before closing branches, improving the internet broadband infrastructure, introduction of mobile banking services and so on.

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12. UK Data Service (2013) *Service U.D. (2013).* Available at: https://infuse2011.ukdataservice.ac.uk/InFuseWiz.aspx?cookie=openaccess (Accessed: 12 January, 2023).